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AECB STAFF ANNUAL REPORT ON POINT LEPREAU G.S. FOR THE YEAR 1988

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Canada

Report

AECB STAFF ANNUAL REPORT FOR THE YEAR 1988

TABLE OF CONTENTS

1. INTRODUCTION

2. STATION OPERATION

3. AECB STAFF REVIEW OF OPERATIONAL SAFETY ASPECTS

- 3.1 Station Compliance
- 3.2 Quarterly Reports
- 3.3 Radiation Protection
- 3.4 Station Effluents and Environmental Monitoring
- 3.5 Process Systems
- 3.6 Performance of Special Safety Systems
- 3.7 Significant Events
- 3.8 Quality Assurance
- 3.9 Station Maintenance
- 3.10 Chemistry Control
- 3.11 Station Management
- 3.12 Training
- 3.13 Emergency Exercises and Drills
- 3.14 Security
- 3.15 AECB Staff Inspections
- 3.16 Measures of Station Performance

4. SIGNIFICANT LICENSING MATTERS AND ACTIVITIES

- 4.1 Licence Renewal
- 4.2 Containment Leak Rate Testing
- 4.3 Automatic Trip of Heat Transport Pumps
- 4.4 Follow-up to the Chernobyl Accident
- 4.5 Steam and Feedwater Failures in the Turbine Building

5. CONCLUSIONS

Attachment A: Summary of Station Performance Indicators

1. INTRODUCTION

This report is a review by AECB staff of the operation of Point Lepreau Nuclear Generating Station during 1988. The review is based on information contained in the various documents submitted by the New Brunswick Electric Power Commission under the terms of the licence and on information gathered by AECB staff via inspections, audits and rounds.

2. STATION OPERATION

Overall, the station operated very well during 1988, achieving a total gross generation of 5.7 TWh and a gross capacity factor (GCF) of 95.7%. There were no forced outages during the year. Outages to accommodate maintenance activities totalled approximately 17 days; 2 days in February to repair a small D_2O leak in the east feeder cabinet and 15 days in late April to conduct scheduled annual maintenance, inspections and overhaul work. The 1988 station performance places it 6th best in the world on the basis of annual gross capacity factor and 2nd best on the basis of lifetime GCF.

3. AECB STAFF REVIEW OF OPERATIONAL SAFETY ASPECTS

3.1 Station Compliance

There were no observed non-compliances with the conditions of the Reactor Operating Licence during the year.

3.2 Quarterly Reports

The required reports of station operation (Ref ROL 5/88 Condition A.A 22) were submitted on time. AECB staff has reviewed these reports in detail and concludes that the necessary information has been supplied and that the licensee has reported in a thorough, accurate manner.

3.3 Radiation Protection

There were no exposures in excess of regulatory limits during the year. The total dose accumulated was 814 person-mSv shallow dose and 702 person-mSv deep dose. Of the deep dose, approximately 35% was attributed to tritium exposure.

The dose distribution was:

Dose	Number of Persons	
	1988	1987
0 to 0.19 mSv	760	837
0.2 to 5 mSv	310	305
5.1 to 10 mSv	30	29
10.1 to 15 mSv	5	7
15.1 to 20 mSv	1	1

There were no exposures in excess of 20 mSv. There was one unusual radiation occurrence during the year; that being the apparent tampering with an employee's TLD badge which is discussed under Section 3.7, Significant Events, UE 88-03.

3.4 Station Effluents and Environmental Monitoring

3.4.1 Station Effluents

Airborne tritium releases for the year were 2.2 E14 Becquerels (Bq), corresponding to 1.4 E-2 percent of the Derived Emission Limit (DEL). Noble gas releases amounted to 3.2 E11 Bq, or 9.6 E-5 percent DEL.

Iodine-131 gaseous releases totalled 5 E7 Bq or 1.8 E-3 percent DEL. There were no airborne particulate releases in 1988.

The airborne releases correspond to a dose of 0.8 uSv to an individual in the Critical Group at a distance of 1 kilometre from the station.

The liquid effluent activity releases amounted to 9.7 E-4 percent of DEL for 1988. This corresponds to a dose of 0.05 uSv to a member of the Critical Group.

3.4.2 Environmental Monitoring

The environmental monitoring program was conducted satisfactorily during 1988. There was no dose recorded at the environmental TLD sites which could be attributed to station operation.

The only radionuclide found by the environmental monitoring program which can be related to Point Lepreau G.S. operation is tritium, in trace quantities.

3.5 Process Systems

There were no serious process failures in 1988. (A serious process system failure is one which requires the response of one or more special safety system to prevent fuel failures and/or the release of radioactive material to the environment).

Highlights relating to process system operation during the year are:

- a trial "heat sink monitor" software package was installed in the station process control computers (DCC's). The software, developed by the NBEPC, would assist the operator in identifying and responding to events in which adequate fuel cooling could be compromised.

- inspections of secondary side piping were done during the year to assess the extent of erosion/corrosion damage. Piping sections were replaced where the damage was deemed to be too great.

- modifications were made to improve the ability of the annulus gas system to detect leaks from pressure tubes.

- a leaking tube in a steam generator was found and successfully plugged during the April shutdown.

3.6 Performance of Special Safety Systems

The two shutdown systems, SDS1 and SDS2 were completely available throughout the year. There were no events requiring automatic reactor shutdown by actuation of either system during 1988.

The containment system accumulated some unavailability during the year; 0.1 hours from the faulty airlock operation described in UE 88-06 below and 0.95 hours from the loss of local air coolers described in UE 88-04. The system's calculated past unavailability in 1988 was 0.12E-3 years/year. (Target 1.0 E-3 years/year)

The Emergency Core Cooling System did not meet its target unavailability. In total, 345 hours of unavailability were accumulated, equivalent to a calculated past unavailability of 39E-3 years/year. The target unavailability of this system is 1.0E-3 years/year. The causes of this unavailability are discussed in UE 88-05 below.

3.7 Significant Events

There were 6 Unplanned Event reports required to be submitted by the NBEPC to AECB staff during 1988. Each event report is summarized below.

UE 88-01 - Failures of Class II 120 VAC Inverter

On three occasions, one of the class II, 120 VAC Inverters (55520-INV1B) failed, thereby interrupting the power supplied to portions of the regulating system and the special safety systems. Each time, the equipment also failed to automatically connect to backup 120 VAC supplies and operator action was required to restore power to the affected portions of the systems.

After each failure, the inverter was thoroughly checked, failed components were replaced and the inverter tested before its return to operation. Although the root cause of the problems has not been identified, the inverter operated satisfactorily during the balance of the year.

UE 88-02 - Failure of Turbine Tripping System

In early May, routine on-line testing of the turbine trip system revealed that both main trip plungers of the system would not respond to simulated trip conditions. The system was thus totally unavailable to protect the turbine from any event which required it to be automatically and rapidly taken off-line. The turbine governing system was available however to respond to overspeed events albeit at a slower rate.

Operating Policies and Principles require that the turbine generator be taken off-line in a controlled manner if the tripping system is not

available. During the preparations for the removal of the turbine from service, the operators succeeded in obtaining a proper response from both trip plungers thereby allowing for continued turbine operation.

New "O-Ring" seals had been installed on the plungers about one month before the discovery of the failure. The slightly larger diameter of the new, unworn "O-Rings" is believed to have caused the plungers to bind in their cylinders. Although proper operation of the tripping system had been verified by tests following the installation of the new seals, those tests had apparently not been sufficient to fully wear-in the new seals.

The frequency of trip system testing was immediately increased from once per month to once per 8-hr shift when the problem was discovered. This increased frequency was maintained for 3 weeks, then gradually reduced as confidence was gained that the new seals were properly seated. No further failures occurred during the balance of the year.

UE 88-03 - Abnormal TLD Result

On 88-05-10, during routine bi-weekly readout of dosimeters, one employee's TLD indicated a dose of 145 mSv on one of its four elements. The other three TLD elements exhibited doses from 0.44 to 8.84 mSv.

Upon investigation, it was found that:

- the 145 mSv dose was inconsistent with the employee's work history during the monitoring period;
- other dosimetry devices worn by the employee during the period did not indicate such an abnormally high dose;
- the TLD in question responded accurately to test irradiations; and,
- the abnormally high dose and the dose distribution among the TLD elements could be closely duplicated by exposing the TLD to a check source used for testing radiation survey instruments.

On the basis of these findings, it was concluded that an unknown person had tampered with the TLD by deliberately exposing it to the instrument check source radiation. The dose was thus deemed non-personal.

UE 88-04 Partial Loss of Class III Power/Partial Unavailability of Containment

An electrical ground fault in the motor of one of the 16 Local Air Coolers (a sub-system of containment) supplied by class III power caused a trip of the feeder breaker to the respective class III motor control center (MCC).

Loss of the supply to the MCC caused a further loss of equipment, including 7 more local air coolers. Failure of the 8 (total) class III Local Air

Coolers constituted a Level 1 impairment of containment. Adequate local air cooler capacity was restored within 50 minutes to terminate the impairment.

Normally, the ground fault would be expected to trip only the breaker supplying the faulted motor and not effect a trip of the motor control center feeder breaker. The ground fault protection in the latter is however more sensitive than that installed on individual motor breakers. In the subject event, the greater sensitivity of the feeder breaker caused it to open before the motor breaker could respond to the ground fault.

The NBEPC is continuing to investigate methods by which the ground fault protection on individual motor breakers could be made more sensitive to avoid future events of this type.

UE 88-05 Level 1 Impairment of Emergency Core Cooling

Scheduled monthly testing of the High Pressure Emergency Core Cooling (HPECC) gas valves revealed that the EVEN side valve, PV82, would not open, apparently due to a seized solenoid valve which supplies air to it. The fault was repaired within 4 hours and the test repeated successfully.

On the subsequent shift, the ODD side valve PV81 was tested and found to be similarly faulted. An immediate retest of this valve succeeded in driving it open. Since it failed its first test however, a level 1 impairment was assigned to the overlapping faults. The fault duration was 1/2 the monthly test interval or about 342 hours.

A follow-up test of these valves was conducted six days later. In that test, the ODD side valve PV81 failed to stroke open on the first attempt but did so successfully on a second test. This test confirmed that the problem was related to faulty operation of relays in the logic circuits controlling the air supply solenoid valve. It is believed that the faulty relays were also responsible for the original failures of the injection valves.

The retest of the EVEN side valve PV82 was successful on the first attempt. However, during the six day period between tests, this flow path had been made unavailable on 3 occasions for maintenance. Thus, an additional 3 hours of system unavailability was accumulated from the deliberate unavailability of PV82 while an unknown fault existed in the logic circuits associated with PV81.

As a follow-up to this event, a program was initiated to investigate the performance of other relays of the type which were responsible for these failures of the HPECC gas injection valves.

UE 88-06 Breach of Containment

A loose mechanical actuator plate on an airlock door was responsible for a 6 minute breach of containment which occurred when an operator attempted to pass through the airlock. The plate actuates two switches which inflate

the seals on the door and a third switch which signifies that the door is closed and locked, thereby permitting the other airlock door to be opened. In the subject event, the loose plate apparently allowed the door seals to deflate during the sequence of opening the other door, creating a breach of containment.

3.8 Quality Assurance

AECB staff, together with NBDOL staff audited a portion of the station Quality Assurance (QA) program in January. There were no significant deficiencies uncovered in the QA program by this audit.

3.9 Station Maintenance

The station maintenance program was conducted satisfactorily during the year. Station staff completed approximately 8500 planned, scheduled maintenance call-ups which corresponds to more than 98% of the scheduled call ups for that period.

Unscheduled work orders completed in 1988 totalled about 10,000 items; the generation rate of unplanned work was approximately 40 new items per working day.

3.10 Chemistry Control

There were no significant problems experienced in maintaining adequate control of station chemistry during the year.

There were two abnormal events relating to station chemistry control in the second quarter. The first event involved the inadvertent connection of a bottle of nitrogen to the helium filled heat transport cover gas system. The bottle was removed and the cover gas system purged after the resultant abnormally high nitrogen concentration was annunciated.

The second event also affected the heat transport system. A special ion exchange column was incorrectly placed into service and caused the system pH to drop rapidly to below its lower specified limit. The column was removed from service and system pH returned to normal.

3.11 Station Management

AECB staff approved the appointments of Mr. J.D. Sommerville to Station Manager and Mr. R. Johnson to Production Manager during the year.

3.12 Training

NBEPC personnel achieved a success rate of 85% in 20 candidate-examinations towards obtaining AECB authorizations as Shift Supervisors or Control Room Operators. In July, the utility contracted with CAE Ltd. of Montreal to supply a full-scope simulator for Point Lepreau G.S. The simulator is scheduled to be operational in mid-1991.

3.13 Emergency Exercises and Drills

The 1988 Point Lepreau G.S. fourth quarter report shows that two of the five shift crews did not conduct any drills related to contingencies during the year and that only 2 crews received 2-day contingency response refresher training.

AECB staff considered initially that increased emphasis on this type of training would appear to be desireable and brought this view forward during the annual review meeting with the licensee. These discussions highlighted that contingency drills and contingency refresher training are conducted on an 18-month and a 24-month cycle respectively. When the records of shift training are examined on these time frames, there appears to be an adequate program in place to ensure that crews are properly prepared to respond to contingencies in an effective manner.

3.14 Security

There were no security-related incidents during 1988. A security contingency exercise was conducted in November for staff training. The exercice did not reveal any significant deficiencies in the security arrangements

3.15 AECB Staff Inspections

Throughout the year, AECB staff conducted inspections of the station operation, maintenance and administration. There were no significant safety-related deficiencies identified by these inspections.

3.16 Measures of Station Performance

Indicators of the quality of overall station operation have been tabulated in Attachment A with the corresponding 1987 information included for comparison.

4. SIGNIFICANT LICENSING MATTERS AND ACTIVITIES

4.1 Licence Renewal

The operating licence for the station was renewed in June 1988. The next renewal date is June 1990.

4.2 Containment Leak Rate Testing

The renewed licence contained a condition requiring that the NBEPC perform a leak rate test on the containment system by June 30, 1989. This condition was subsequently revised, on the recommendation of AECB staff to postpone the deadline of the containment test to December 31, 1989. The extension will give the licensees additional time to develop and implement changes which are expected to improve the leak rate and allow closer monitoring of changes in it.

4.3 Automatic Trip of Heat Transport Pumps

The NBEPC designed a feature which would initiate the automatic tripping of the Heat Transport Pumps during a loss-of-coolant accident. This trip would alleviate concerns which might otherwise arise regarding the possibility that vibrations, induced in the HTS piping by running pumps under depleted inventory conditions, could endanger the piping integrity.

The design of the trip and the analysis supporting the design were reviewed and discussed during the year with the NBEPC. The design has subsequently been approved and will be installed in early 1989.

4.4 Follow-Up To Chernobyl Incident

The NBEPC has submitted satisfactory responses to four of the seven topics which needed to be addressed by licensees following AECB staff's review of the Chernobyl accident.

Two of the remaining three topics deal with the effectiveness of the shutdown systems under accident conditions and are being dealt with on a generic basis in conjunction with AECL and Hydro Quebec. A report on the results of this work is expected in the spring of 1989.

The third topic concerns the blocking of handswitches on special safety systems and has not yet been addressed satisfactorily by N.B. Power. Further information is expected in 1989.

4.5 Steam and Feedwater Failures in the Turbine Building

The NBEPC continued with its increased inspection of secondary side piping and, during the 1988 outage, several sections of piping and pieces of equipment were replaced. In addition, chemical treatment of the feedwater was altered to decrease the potential for corrosion.

The structural reinforcement of the building is scheduled for 1989 and additional analyses are being carried out to determine the peak pressure and temperature transients to be expected in the event of a main steam line failure. This will determine the pressure relief requirements for the building. The results of these analyses are scheduled to be submitted in spring 1989.

5. CONCLUSIONS

AECB staff considers that the station has been operated and managed in a safe manner during 1988. The staff is satisfied that the NBEPC is proceeding properly towards resolution of any ongoing or outstanding work identified in this report.

ATTACHMENT 'A' - SUMMARY OF STATION PERFORMANCE INDICATORS

POINT LEPREAU G.S. - 1988

		1988	1987	AECB STAFF COMMENTS TO BE CONSISTENT WITH BRUCE G.S. FORMAT (A = ACCEPTABLE) (NI = NEEDS IMPROVEMEN
A. Radiation Control				
Total Deep Dose		703 person-mSv	758 person-mSv	A
Total Shallow Dose		813.5 person-mSv	914 person-mSv	A
Total Extremity Dose		28.5 person-mSv	0.9 person-mSv	A
Total F/H Deep Dose		112 person-mSv	144 person-mSv	A
Total F/H Shallow Dose		116 person-mSv	156 person-mSv	A
Total Neutron Dose		57.4 person-mSv	40.8 person-mSv	A
Number of Exposures >Regulatory Limits		0	0	A
Number of Radiation Related Supervisor's Investigations		1	1	A
Releases from the station				
a) Airborne				
Tritium:	No of weeks >1% DEL	0	0	A
	Average % DEL for year	1.4 E-2	1.4 E-2	A

ATTACHMENT 'A' - SUMMARY OF STATION PERFORMANCE INDICATORS

POINT LEPREAU G.S. - 1988

		1988	1987	AECB STAFF COMMENTS (A=ACCEPTABLE) (NI=NEEDS IMPROVEMENT)
Releases from the station (cont'd)				
Noble Gas:	No of weeks >1% DEL	0	0	/
	Average % DEL for year	9.6 E-5	2.7E-5	A
Iodine 131:	No of weeks >1% DEL	0	0	A
	Average % DEL for year	1.8 E-3	0	A
Particulates:	No of weeks >1% DEL	0	0	A
	Average % DEL for year	0	0	A
b) Waterborne				
Tritium:	No of months >1% DEL	0	0	A
	Average % DEL for year	2.5 E-4	2 E-4	A
Gross :	No of months >1% DEL	0	0	A
	Average % DEL for year	7.2 E-4	6.1 E-5	A

ATTACHMENT 'A' - SUMMARY OF STATION PERFORMANCE INDICATORS

POINT LEPREAU G.S. - 1988

	1988	1987	AECB STAFF COMMENTS (A=ACCEPTABLE) (NI=NEEDS IMPROVEMENT)
Environmental Measurements			
Average Boundary dose rate[1]	0.85 μSv/y	0.7 μSv/y	
Mean Boundary Tritium in Air	1 Bq/m^3	1 Bq/m^3	
B. Plant Control			
Number of completed Reactor Trips	0	1	A
Number of Serious Process Failures	0	0	A
Special Safety System Unavailability (years/year)			
SDS1	0	0	A
SDS2	0	7.9 E-6	A
CONTAINMENT	0.12 E-3	0	A
ECCS	39 E-3	0	NI

[1] These are calculated values based on average plant emissions. The actual background dose rate at the exclusion zone boundary is about 800 microsievert/yr.

ATTACHMENT 'A' - SUMMARY OF STATION PERFORMANCE INDICATORS

POINT LEPREAU G.S. - 1988

	1988	1987	AECB STAFF COMMENTS (A=ACCEPTABLE) (NI=NEEDS IMPROVEMENT)
Number of Safety Related/ Support Systems not meeting availability target	1	0	A
Number of Reportable Incidents	5	9	A
Number of fires	0	0	A
Number of Significant Operator errors reported	0	0	A
AECB compliance inspections "unsatisfactory"	0	1	A
Number of forced outages	0	1	A
C. Plant Administration			
Documentation			
Average No. of operating memos in force	28	18	A
No memos extant> 6 months	17	17	A
No. of systems (USI) with >1 Operating Memo Extant	4	1	A
No of AECB Document deficiency reports issued	0	1	A
No of operating memos behind schedule for review	0	0	A